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Applicant	:	Joseph Dale Helmick
Appl. No.	:	09/878,811
Filed	:	06/10/2001
Title	:	Uncertain and complex system teaches neural networks
Grp./A.U.	:	2122
Examiner	:	Michael Holmes

Honorable Commissioner for Patents
Washington DC

AMENDMENT

Honorable Commissioner:

With certificate of mailing and in good faith before the first office action, please amend the above identified application as follows:

In the Title

Please amend the title as follows:

(Amended) --Statistical mechanics system teaches neural networks –

In the Other References

Please add the following references with the following:

(New) --W. Kahan, *Branch Cuts for Complex Elementary Functions*, in *The State of the Art in Numerical Analysis* eds. A. Iserles & M. J. D. Powell, Clarendon Press, Oxford, 1987.

J. Helmick, Quantum Theory: reconsideration of foundations (Conference), A. Khrennikov ed., *A Non-Congruential Generator Extracts Descending Objects to Finite Sets of Zero Vector* (Abstract presentation), , Vaxjo Univ. Press, Sweden, June 2001.

E1

J. Helmick, Proceedings of the Conference on Quantum Theory: reconsideration of foundations, A. Khrennikov ed., *Set Theory to Physics* (Pre-print), Vaxjo Univ. Press, Vaxjo, 2002.--

In the second reference please replace the word *Engineers* in the title with the following:

(Amended) --R.D. Sriram, *Intelligent Systems for Engineering*, Springer-Verlag, Berlin, 1997, pp.341, 471-513.--

E2

In the Background of the Invention

Please amend paragraph 1 page 3 line 1 as follows:

E3

(Amended) --The invention presents a statistical mechanics system of non-congruential algorithms that teaches Artificial Neural Networks nonlinear functional mapping for control and numerical modeling, and among the more particular, to manipulate generated output of multiple sequences and to implement a new operating system.

In the Summary of the Invention

Please amend paragraph 1 page 3 line 10 as follows:

E4

(Amended) --Analysis of the two most widely used transcendental numbers e and π extends from classical mechanics to mathematical applications like computing billions of digits of π. The computation of digits to extraordinary lengths demonstrates the value of mathematics to computer science. Introspection on the quantum aspect of the decimal expansions of e, π, $(2)^{1/2}$ and $(3)^{1/2}$ is more intuitively understood from the statistical mechanics of decimal positions relative to special angles in degrees and radians on the unit circle. "Numerical- learning-based algorithms focusing on Artificial Neural Networks", i.e. Multilayer Perceptron Network, Kohonen Self-Organizing Network, and Hopfiield Network have not yet learned the "nonlinear mapping functions for control and numerical modeling from input sets to output sets" of this non-congruential system.

Please add the word "*yod*" before "group" on page 3, paragraph 2, line 3:

E5

(Amended) --Application of the non-standard theory $-(-a) = -a$ extends from arbitrary degrees to a measure of the natural scale of Euclidean geometry with a secondary extension to a complex *yod* group of symmetric and descending objects with one embedded quaternionic orbit. At the end of the $-(-a) = -a$ *yod* group descent, $5\pi/4$ on the unit circle makes sense in terms of $-x = -y$ for a logical approach to a definition of *zero vector* in polar coordinates. Numeric simulations of the algorithms at 1,000,000 LengthOfString digits display preliminary evidence of convergence by the output of many sequences.

Please add "/detection" in the second to last line on page 3:

E6

(Amended) --The values $(2)^{1/2}$ and $(3)^{1/2}$ are specifically chosen because 2 and 3 are the only operands of the square root function in the solutions to sine, cosine and tangent computations from the standard double negative equals a positive view of the Pythagorean theorem and the special angles on the unit circle. Furthermore, operation of the zero factor property is questioned in the multiplicative identity of

E6

zero when defined as an operation of repeated addition. Last, propositional functions are constructed from the extraction/detection of numerical sequences. --

Please add "/detection" on page 4 lines 2 and 3:

(Amended) -- The reason why the isosceles triangle of Hilbert's 7^{th} problem was chosen to triangulate the mechanism of extraction/detection (Δ) is because the angle and length ratios are in pairs just as the special angle seed matrices extract/detect digit pairs from e and π, $(2)^{1/2}$ and $(3)^{1/2}$. Since there are only 3 angles and 3 sides to the Hilbert isosceles triangle, then only three input values run simultaneously appear to make sense. But the operands 2 and 3 appear in the trigonometric computations of the Pythagorean theorem on the unit circle. Therefore, $(2)^{1/2}$ and $(3)^{1/2}$ are included as separate simulations the same as e and π, and all four input values are tested as well. Also the one-to-one correspondence of decimal positions to arbitrary degrees on the unit circle and the one-to-one correspondence of degrees-radians conversion imply a special angles in radians to decimal positions one-to-one correspondence thereby completing the isosceles triangle. --

E7

In the Brief Description of the Drawings

Please amend FIG.1 as follows:

(Amended) -- FIG. 1 shows a map of the closed loop for the statistical mechanics system; --

E8

In the Detailed Description of the Invention

On page 4 please delete "uncertain and complex" and add "statistical mechanics" in paragraph 1 as follows:

(Amended) -- The closed loop of FIG. 1 represents a statistical mechanics system with phase space transitions of arbitrary degrees to natural radians, natural radians to *yod*, and *yod* to *zero vector*. The nonlinear functional mapping from input to output of each operator, Δ representing *match-with-rotate* algorithm, *yod* representing *cusp root method*, and *zero vector* algorithm needs to be defined. Therefore numerical-learning-based algorithms focusing on Artificial Neural Networks are used as learning tools for control and numerical modeling from input to output sets. --

E9

Please add the following paragraph after the paragraph 1 in the Detailed Description of the Invention on page 4 as follows:

(New) -- The operational function, $dL/d\theta$ where L is LengthofString for π, e, $(2)^{1/2}$ or $(3)^{1/2}$ decimal expansions and θ is the 16 special angles converted from degrees to radians, is expressed as a quotient of integers where the numerator is in terms of

E10

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length of decimal position and the denominator in terms of degrees/radians on the unit circle *mod 360.*--

Please add "/detected" on page 6, paragraph 4, line 5 and "±" in line 6 as follows:

E11

(Amended) --The output sequences for all combinations of seed matrices in 1.) matching digits 2.) matching special angles in degrees or radians 3.) matching special angle positions 4.) matching special angle positions in terms of sector-area and 5.) one, two, three, or four input remainder values segmented by $x_n - x_{n-1} = r_n$ with empty digit positions intact where the matching digits were extracted/detected from, extend to infinity defined as 1/0 at the origin and are symbolized by the non-Euclidean ±0°-90°-90° intermediary structure. The sequences recombine in permutations of an extraneous dimension at the origin of polar coordinates. A graph of the distribution of matching digits and matching special angles for 286 coordinate pairs (of which 76 are noted on the graph) (FIG. 6) shows symmetry of bilateral concavities and suggests a relation common to matching digits and matching special angles.--

Please add "/detected" to the last paragraph starting on page 6 and ending at the beginning of page 7 line 4 as follows:

E12

(Amended) --The total number of generated sequences depends on the number of input values. The input remainder values segmented by $x_n - x_{n-1} = r_n$ where the matching digits are segmented according to the factor theorem such that, if r (decimal position of matching digits) is a zero of the polynomial $P_{(x)}$ (input values) then (x - r) is a factor of $P_{(x)}$. The decimal position of matching digits is defined as a segment length from $x_0 = 0$ for the start of e, π, $(2)^{1/2}$ and $(3)^{1/2}$ in combinations of two, three and four input values, and x_1 = decimal position of the first matching digits, then $x_1 - 0 = r_1$, $x_2 - x_1 = r_2$, ... $x_n - x_{n-1} = r_n$ and for each extracted/detected digit position, a term from the matching special angle sequence is inserted in a one-to-one correspondence as the y-component (for height on the unit circle) in an ordered pair such that ($x_n - x_{n-1} = r_n$, matching special angle) equals the (x, y) coordinate pair. The matching special angle positions sequence in terms of sector-area arc also matched in a one-to-one correspondence with the ($x_n - x_{n-1} = r_n$, matching special angle) coordinate pairs such that the digits of the x-component are distributed in clusters (according to frequency of digits occurring in the x-component) over the sector-area. The coordinate pair y-component (matching special angles) is the height on the unit circle and is one-to-one correspondence with the matching special angle positions (in terms of sector area).--

Please add "±" on page 7 paragraph 1 line 3 as follows:

E13

(Amended) --*Zero vector* is determined by θ only and corresponds to the null set (FIG. 5) of the *yod* group, for example in the 16 special angles from $0 + 0\pi k + 0$ to $0 + 2\pi k + 0$ on the polar origin. Implementation of a non-Euclidean metric ±0°-90°-90° triangle (FIG. 1) is an example of a random tool designed for an infinite task.

E13

Definition of *zero vector* and elementary properties of vectors in a probability context suggest the curvature of a line between 2 points on a non-Euclidean surface results in the behavior of "shortest" lines such that 1.) a ±0 domain with +0 intersect –0 = vacuous, 2.) vacuous does not equal True or False, 3.) null intersect null = disjoint, and 4.) *a* does not equal zero, *a* such that $a^2 = 0$, 4.) sum of vectors in the identity element law is non-commutative by **a** + **0** does not equal **0** + **a**, 5.) the commutative property of multiplication defined as a repeated series of addition such that adding zero five times is valid but adding 5 zero times is not valid, and 6.) the four values of minimum-maximum $\pm\infty = 1$ of an operating system.--

Please add "±" on page 7 paragraph 2 line 1 as follows:

E14

(Amended) --The non-Euclidean ±0°-90°-90° metric, which extends to infinity at the vertex, is an intermediate form of the Δ Hilbert isosceles triangle. In the ±0°-90°-90° metric, however, the ratio of orthogonal base angles to the vertex angle at infinity present polar coordinates at the origin that depend only on θ for the direction of "shortest" lines radii.--

Please amend page 7 paragraph 3 line 1 as follows:

E15

(Amended) --The balanced ratios of the system are: (16/16; 7/16 6/16 5/16 4/16 3/16 2/16 1/16; 16/16) that corresponds to 16 by 7 by 16 symmetry and (16/16; 7/16 6/16 5/16; 4/16 (infinite loop); 3/16 2/16 1/16; 16/16) that corresponds to 16 by 3 by 1 by 3 by 16 symmetry (FIG. 7) and the case 16 by 8 for null set = *zero vector* as an element of *yod*.--

Please add on page 8 after the end of the first 6 lines and before the paragraph beginning with "Similar in function ..." the sentence and code as follows:

E16

(New) --*Match-with-rotate* is coded in Mathematica as follows:

```
Programming Parameters & Packages
    Needs [ "Graphics ' Graphics' " ]
    Needs [ "Statistics ' DataManipulation ' " ]

    LengthofString = 1000000

Digit Representations

    d = RealDigits [ E, 10, LengthofString ] [ [1] ] ;
    c = RealDigits [ Pi, 10, LengthofString ] [ [1] ] ;
```

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Digit Representations In Special Angles

```
SpecialAngles =

  (Table [
    { 0 + 2 Pi k + 30, 0 + 2 Pi k + 30 + 15, 0 + 2 Pi k + 30 + 30, 0 + 2 Pi k + 30 + 60, 0 + 2 Pi k + 30 + 90,
     0 + 2 Pi k + 30 + 15 + 90, 0 + 2 Pi k + 30 + 30 + 90, 0 + 2 Pi k + 30 + 60 + 90, 0 + 2 Pi k + 30 + 180,
     0 + 2 Pi k + 30 + 15 + 180, 0 + 2 Pi k + 30 + 30 + 180, 0 + 2 Pi k + 30 + 60 + 180,
     0 + 2 Pi k + 30 + 270, 0 + 2 Pi k + 30 + 15 + 270, 0 + 2 Pi k + 30 + 30 + 270,
     0 + 2 Pi k + 30 + 60 + 270} , { k, 0, .95 LengthOfString / 360 } ] / / Flatten ) /. Pi -> 180 ;

cc = Part [ c, (Table [
     { 0 + 2 Pi k + 30, 0 + 2 Pi k + 30 + 15, 0 + 2 Pi k + 30 + 30, 0 + 2 Pi k + 30 + 60, 0 + 2 Pi k + 30 + 90,
     0 + 2 Pi k + 30 + 15 + 90, 0 + 2 Pi k + 30 + 30 + 90, 0 + 2 Pi k + 30 + 60 + 90, 0 + 2 Pi k + 30 + 180,
     0 + 2 Pi k + 30 + 15 + 180, 0 + 2 Pi k + 30 + 30 + 180, 0 + 2 Pi k + 30 + 60 + 180,
     0 + 2 Pi k + 30 + 270, 0 + 2 Pi k + 30 + 15 + 270, 0 + 2 Pi k + 30 + 30 + 270,
     0 + 2 Pi k + 30 + 60 + 270} , { k, 0, .95 LengthOfString / 360 } ] / / Flatten ) /. Pi -> 180
  ];

dd = Part [ d, (Table [
     { 0 + 2 Pi k + 30, 0 + 2 Pi k + 30 + 15, 0 + 2 Pi k + 30 + 30, 0 + 2 Pi k + 30 + 60, 0 + 2 Pi k + 30 + 90,
     0 + 2 Pi k + 30 + 15 + 90, 0 + 2 Pi k + 30 + 30 + 90, 0 + 2 Pi k + 30 + 60 + 90, 0 + 2 Pi k + 30 + 180,
     0 + 2 Pi k + 30 + 15 + 180, 0 + 2 Pi k + 30 + 30 + 180, 0 + 2 Pi k + 30 + 60 + 180,
     0 + 2 Pi k + 30 + 270, 0 + 2 Pi k + 30 + 15 + 270, 0 + 2 Pi k + 30 + 30 + 270,
     0 + 2 Pi k + 30 + 60 + 270} , { k, 0, .95 LengthOfString / 360 } ] / / Flatten ) /. Pi -> 180
  ];

 Length [ cc ]
```

Special Angle Number (1 = Pi / 6, 2 = Pi / 4 ...) for Matching Digit Positions

```
 Flatten [ Position [ Table [ dd [ [ k ] ] == [ [ k ] ],  { k, 1, Length [ cc ] } ] , True] ]
```

Matching Special Angles

```
 Part [
   (Table [
    { 0 + 2 Pi k + 30, 0 + 2 Pi k + 30 + 15, 0 + 2 Pi k + 30 + 30, 0 + 2 Pi k + 30 + 60, 0 + 2 Pi k + 30 + 90,
     0 + 2 Pi k + 30 + 15 + 90, 0 + 2 Pi k + 30 + 30 + 90, 0 + 2 Pi k + 30 + 60 + 90, 0 + 2 Pi k + 30 + 180,
     0 + 2 Pi k + 30 + 15 + 180, 0 + 2 Pi k + 30 + 30 + 180, 0 + 2 Pi k + 30 + 60 + 180,
     0 + 2 Pi k + 30 + 270, 0 + 2 Pi k + 30 + 15 + 270, 0 + 2 Pi k + 30 + 30 + 270,
     0 + 2 Pi k + 30 + 60 + 270} , { k, 0, .95 LengthOfString / 360 } ] / / Flatten ) /. Pi -> 180 ,
  Flatten [ % ]
  ]
```

E16

Matching Digit Pairs

MatchingDigits = c [[%]]

d [[%%]]

Frequencies [MatchingDigits]

Histogram [MatchingDigits]

Table [ListPlot [Transpose [{ Drop [MatchingDigits, k] , Drop [MatchingDigits, - k] }]] ,
{ k, 1, 100, 10}] --

Please add on page 11 line 3 the equation as follows:

--∂^2 Ey / ∂ t^2 = A cos [$(-)^{1/2}$ ωt + Δ φ°]

E17

∂^2 Ey / ∂ t^2 = A cos [$(-)^{1/2}$ ωt + Δ φ°] (*zero vector*)

(New) -- ∂^2 Ey / ∂ t^2 = A cos (ωt + φ°) + Δ + $(-)^{1/2}$ + *zero vector*--

Please add "/detection" on page 11 paragraph 1 line 5 as follows:

E18

(Amended) --For actuation in signal processing of numeric simulations of measurements to detect objects in the sky using electromagnetic mathematical modeling and electromagnetic measurement systems involves problems and applications of signal identification, data compression, and nonlinear functional mapping. The operators Δ = mechanism of extraction/detection for *match-with-rotate* algorithm, $(-)^{1/2}$ = *yod* for *cusp root method* algorithm, and *zero vector* algorithm open new dimensions for finer resolution and less noise.--

In the Claims

Please amend page 12 claim 1 paragraph 1 line 1 line 8 line 10, paragraph 2 line 5, paragraph 4 line 2 and please add paragraph 5 as follows:

E19

(Amended) --1. Numeric control and modeling of the statistical mechanics non-congruential generator system of algorithms defined by multiple seed matrices of 1.) *match-with-rotate* for all 16 special angles on the unit circle 2.) *cusp root method*, a descending chain of 7-1 special angles from 5π/6 to 5π/3 (with resonance orbits and infinite loop) on the unit circle and 3.) *zero vector*, i.e. null set of *yod* group, for all 16 special angles from 0πk to 2πk defined in terms of only θ

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